CLAIMS

1. An inflator for inflating a cushion of an airbag module for protecting an occupant of a vehicle from impact, the inflator comprising:

a quantity of compressed gas;

an anode; and

a cathode;

wherein one of the anode and the cathode extends through at least a portion of the other of the anode and the cathode such that the anode and the cathode cooperate to produce a voltage across at least a portion of the compressed gas to induce expansion of the compressed gas in response to application of an activation signal to the anode and cathode.

2. The inflator of claim 1, wherein the anode and the cathode are disposed to produce the voltage to release the compressed gas from containment within a housing of the inflator.

3. The inflator of claim 2, wherein the anode and cathode are disposed to continue producing the voltage after release of the compressed gas from containment.

4. The inflator of claim 1, wherein the anode and the cathode are coupled to a voltage source that varies the voltage according to severity of a collision in which the vehicle is involved.

5. The inflator of claim 1, wherein the compressed gas comprises a gas selected to dissociate when acted upon by the voltage, the dissociation inducing expansion of the compressed gas.

6. The inflator of claim 5, wherein the compressed gas comprises nitrous oxide.

7. The inflator of claim 1, wherein the compressed gas is of a type selected to combust when acted upon by the voltage, the compression inducing expansion of the compressed gas.

8. The inflator of claim 7, wherein the compressed gas comprises a fuel/oxidizer mix with a concentration selected such that the compressed gas remains under a lean flammable limit of the compressed gas to limit combustion of the compressed gas.

9. The inflator of claim 1, wherein the anode and the cathode are disposed such that the voltage produces an arc across the compressed gas, wherein one of the anode and the cathode comprises a nozzle that directs the portion of the compressed gas through the arc to form an arc-jet.

10. The inflator of claim 1, wherein the anode and the cathode are disposed such that the voltage produces a corona within the compressed gas.

11. An inflator for inflating a cushion of an airbag module for protecting an occupant of a vehicle from impact, the inflator comprising:

a housing;

a quantity of compressed gas stored within the housing;

a nozzle in communication with the compressed gas, the nozzle having a generally tapered interior; and

at least one conductor disposed to produce an electrical arc proximate the nozzle such that at least a portion of the compressed gas passes through the nozzle and is heated by the electrical arc to form an arc-jet in response to receipt of an electric activation signal by the conductor.

12. The inflator of claim 11, wherein the conductor comprises one of an anode and a cathode and the nozzle comprises the other of the anode and the cathode, wherein the conductor comprises a rod disposed proximate the nozzle such that a voltage between the rod and the nozzle produces the electrical arc between the nozzle and the rod.

13. The inflator of claim 11, wherein the nozzle is integrated with an interior wall disposed to define an interior chamber within the housing, the interior wall cooperating with the housing to define an exterior chamber.

14. The inflator of claim 13, further comprising a burst disc disposed to seal the interior chamber from the exterior chamber until the inflator deploys.

15. The inflator of claim 14, wherein the compressed gas comprises a first gas and a second gas different from the first gas, wherein the first gas is disposed within the interior chamber and the second gases is disposed within the exterior chamber.

16. The inflator of claim 13, wherein the housing comprises an outlet end in which at least one outlet orifice is formed, wherein the nozzle is formed proximate the outlet end such that a majority of the compressed gas flows past the nozzle to reach the outlet orifice.

17. The inflator of claim 13, further comprising a supplemental wall attached to the housing to define a supplemental chamber between the housing and the supplemental wall, wherein the supplemental chamber is in communication with the interior chamber.

18. The inflator of claim 13, wherein the exterior chamber comprises an exterior chamber divider disposed to separate the exterior chamber into an outlet portion and a distal portion, wherein the interior chamber is disposed generally between the outlet portion and the distal portion.

19. An inflator for inflating a cushion of an airbag module for protecting an occupant of a vehicle from impact, the inflator comprising:

a housing;

a quantity of compressed gas stored within the housing; and

at least one conductor disposed to produce an electric corona within the housing such that at least a portion of the compressed gas is heated by the electric corona in response to receipt of an electric activation signal by the conductor.

20. The inflator of claim 19, wherein the conductor comprises one of an anode and a cathode and the housing comprises the other of the anode and the cathode, wherein the conductor comprises a rod disposed within the housing such that a voltage between the rod and the housing produces the electric corona between the housing and the rod.

21. The inflator of claim 20, wherein the rod and the housing are coupled to a voltage source that pulses the voltage.

22. The inflator of claim 20, wherein the housing has a generally tubular shape, and wherein the rod comprises a first end and a second end secured at opposite ends within the housing such that the rod is coaxial with the housing.

23. An airbag module for protecting an occupant of a vehicle from impact, the airbag module comprising:

a cushion having a stowed configuration and a deployed configuration in which the cushion is inflated to receive impact of the occupant; and

an inflator comprising an anode and a cathode, wherein one of the anode and the cathode extends through at least a portion of the other of the anode and the cathode such that the anode and the cathode cooperate to produce a voltage across at least a portion of a gas to induce expansion of the gas in response to application of an activation signal to the anode and cathode.

24. The airbag module of claim 23, wherein the anode and the cathode are disposed to produce the voltage to release the gas from containment within a housing of the inflator.

25. The airbag module of claim 24, wherein the anode and cathode are disposed to continue producing the voltage after release of the gas from containment.

26. The airbag module of claim 23, wherein the anode and the cathode are coupled to a voltage source that varies the voltage according to severity of a collision in which the vehicle is involved.

27. The airbag module of claim 23, wherein the gas comprises a gas selected to dissociate when acted upon by the voltage, the dissociation creating additional gas and inducing expansion of the gas.

28. The airbag module of claim 23, wherein the gas is of a type selected to combust when acted upon by the voltage, the combustion inducing expansion of the gas.

29. The airbag module of claim 23, wherein the anode and the cathode are disposed such that the voltage produces an arc across the gas, wherein one of the anode and the cathode comprises a nozzle that directs the portion of the gas through the arc to form an arc-jet.

30. The airbag module of claim 23, wherein the anode and the cathode are disposed such that the voltage produces a corona within the gas.

31. An inflator for inflating a cushion of an airbag module for protecting an occupant of a vehicle from impact, the inflator comprising:

housing;

a gas stored within the housing; and

a plurality of filaments electrically coupled to a voltage source such that a number of the filaments combusts in response to receipt of an activation signal from the voltage source, wherein the number of filaments that combusts is determined by at least one characteristic of the activation signal.

32. The inflator of claim 31, wherein the voltage source is configured to vary the characteristic according to severity of a collision in which the vehicle is involved.

33. The inflator of claim 31, wherein the characteristic is selected from the group consisting of an amplitude of the activation signal and a duration of the activation signal.

34. The inflator of claim 31, wherein the filaments are constructed of a metal.

35. The inflator of claim 34, wherein the filaments are constructed of Zirconium.

36. The inflator of claim 35, wherein the compressed gas comprises oxygen.

37. The inflator of claim 31, wherein the filaments are connected in parallel to form a single circuit such that combustion of a filament eliminates a circuit path and forces current through at least one other filament.

38. The inflator of claim 37, wherein the circuit comprises a plurality of resistors disposed to electrically separate the filaments from each other, wherein the resistors comprises a plurality of different resistances selected to concentrate current flow in each of the filaments in sequence.

39. The inflator of claim 38, wherein each of the filaments is electrically coupled to the housing and to a junction line along which the resistors are disposed, the junction line extending through the housing such that the junction line is only in substantial electrical contact with the housing via the filaments.

40. The inflator of claim 31, wherein each of the filaments is coated with a pyrotechnic that combusts in response to combustion of the filament.

41. The inflator of claim 31, wherein each of the filaments is disposed within a tube that substantially prevents combustion from propagating from the filament to an adjoining filament.

42. A method for providing inflation gas to inflate a cushion of an airbag module for protecting an occupant of a vehicle from impact through the use of an inflator comprising an anode and a cathode, the method comprising:

coupling the anode and the cathode to a voltage source to produce a voltage through a gas disposed in a generally annular space between the anode and the cathode;

inducing expansion of the gas in response to the voltage to provide the inflation gas.

43. The method of claim 42, wherein the inflator further comprises a housing, the method further comprising releasing the inflation gas from the housing in response to the expansion.

44. The method of claim 43, further comprising continuing to produce the voltage to induce expansion of additional gas after release of the inflation gas from the housing.

45. The method of claim 42, wherein the inflator further comprises a housing, the method further comprising igniting a pyrotechnic to release the inflation gas from the housing.

46. The method of claim 42, wherein inducing expansion of the gas comprises inducing combustion of the gas.

47. The method of claim 42, wherein inducing expansion of the gas comprises inducing dissociation of the gas.

48. The method of claim 42, further comprising directing the inflation gas to flow into the cushion.

49. A method for manufacturing an inflator for inflating a cushion of an airbag module for protecting an occupant of a vehicle from impact, the inflator comprising a housing and a conductor with a first end, the method comprising:

inserting a first gas into the housing;

disposing the first end of the conductor within the housing such that an activation signal can be coupled to the housing and to the conductor to produce a voltage through at least a portion of the first gas; and

closing the housing to retain the first gas within the housing.

50. The method of claim 49, further comprising disposing a nozzle within the housing proximate the first end of the conductor and in electrical communication with the housing such that coupling the activation signal to the housing and to the conductor produces an arc between the nozzle and the conductor.

51. The method of claim 50, wherein disposing the nozzle within the housing comprises inserting an interior wall, with which the nozzle is integrated, into the housing to define an interior chamber within the housing.

52. The method of claim 49, wherein disposing the first end of the conductor within the housing comprises disposing the conductor such that coupling the activation signal to the housing and to the conductor produces a corona within the first gas.

53. The method of claim 49, wherein inserting the first gas into the housing comprises inserting a gas selected to combust in response to production of a voltage across the gas.

54. The method of claim 49, wherein inserting the first gas into the housing comprises inserting a gas selected to dissociate in response to production of a voltage across the gas.

55. The method of claim 49, further comprising inserting a second gas into the housing in isolation from the first gas.

56. A method for providing inflation gas to inflate a cushion of an airbag module for protecting an occupant of a vehicle from impact through the use of an inflator comprising a housing, a compressed gas contained within the housing, and a plurality of filaments contained within the housing, the method comprising:

detecting severity of a collision in which the vehicle is involved;

providing an activation signal having at least one characteristic selected according to the severity of the collision; and

conveying the activation signal to a plurality of filaments to induce combustion of a number of the filaments, thereby inducing expansion of the compressed gas, wherein the number is determined by the characteristic.

57. The method of claim 56, wherein the plurality of filaments are incorporated into a single circuit that receives the activation signal, wherein inducing combustion of the filaments comprises concentrating current of the activation signal in one filament at a time to induce the filaments to combust in series.

58. The method of claim 56, further comprising inducing the housing to open to release the compressed gas in response to expansion of the compressed gas.

59. The method of claim 58, further comprising continuing combustion of the filaments after inducing the housing to open to induce expansion of the compressed gas as the compressed gas exits the inflator.

60. A method for manufacturing an inflator for inflating a cushion of an airbag module for protecting an occupant of a vehicle from impact, the inflator comprising a housing, a gas, and a plurality of filaments, the method comprising:

inserting the filaments into the housing;

electrically coupling the filaments to each other to form a circuit such that a number of the filaments combust in response to receipt of an activation signal, wherein the number varies according to at least one characteristic of the activation signal;

inserting the gas into the housing; and

closing the housing to retain the gas within the housing.

61. The method of claim 60, wherein electrically coupling the filaments to each other comprises connecting the filaments in parallel with each filament coupled to the housing and to a junction line.

62. The method of claim 61, wherein electrically coupling the filaments to each other comprises disposing a plurality of resistors to electrically separate the filaments from each other, wherein the resistors comprises a plurality of different resistances selected to concentrate current flow in each of the filaments in sequence.